

Detection and monitoring of COPD severity with wearable photoplethysmography

A wearable, non-invasive point of care tool to diagnose and monitor chronic obstructive pulmonary disorder (COPD) severity with photoplethysmography (PPG) derived thoracic pressure waveforms.

Proposed use

PPG can be incorporated into a wearable technology for monitoring respiratory effort, coughing and compliance with chest physio in post-operative patients and in chronic lung disease patients. The technology can also track respiratory health in consumer wearable to report 'level of obstruction' in asthma patients and in individuals with allergies.

Problem addressed

Currently COPD detection is done by spirometry which is not a wearable instrument and requires medical staff training to be used effectively. Simple exercises like ball-blowing also exist for monitoring respiratory effort and breathing but these techniques are cumbersome and intrusive.

Using PPG for COPD detection does not require any calibration or medical training and can be used to constantly monitor disease indicators and severity of individuals using a wearable. With constant monitoring early signs of disease exacerbation and life-threatening worsening can be detected which will allow more effective patient treatment planning.

Technology overview

Respiratory exertion, which is defined as pressure x time, can be used to diagnose obstructive breathing disorders, infer the severity of obstructive breathing disorders and monitor exacerbations in individuals. If someone suffers from airway obstruction, more thoracic pressure over time is needed to exhale, resulting in an increase in PPG intensity over time. When severity of disease and obstruction increases, the summed pressure across time required for each breathe increases proportionally. This summed pressure over time (respiratory exertion) can be measured with a wearable PPG.

The technology focuses on the distinct COPD features in the PPG respiratory exertion waveforms to distinguish COPD from other restrictive breathing disorders such as pulmonary fibrosis. These distinct features include the difference between positive and negative amplitude and the duration of the waveforms.

Intellectual property information

GB 2211069.6 - Detection and monitoring of respiratory conditions with photoplethysmography (PPG)

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Benefits

- Algorithms and methods are implementable in existing wearable PPG hardware, such as smart watches or smart earphones.
- Acts as a low-cost alternative to hospital examinations in a wearable form factor.
- Enables 24/7, out of clinic monitoring of obstructive breathing disorders.
- Can be used to screen for COPD in consumer wearables.

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